AG

(12) UK Patent Application (19) GB (11) 2 248 707 (13) A

(43) Date of A publication 15.04.1992

(21) Application No 9121440.3

(22) Date of filing 08.10.1991

(30) Priority data
(31) 02268304 (32) 08.10.1990 (33) JP

(71) Applicant
Fuji Photo Film Co Ltd

(Incorporated in Japan)

No 210 Nakanuma, Minami-Ashigara-chi, Kanagawa-ken, Japan

(72) Inventors
Katsuya Makioka
Mikio Watanabe
Osamu Saito

(74) Agent and/or Address for Service
Brookes & Martin
High Holborn House, 52-54 High Holborn, London, WC1V 6SE, United Kingdom

(51) INT CL[5]
G06F 12/00 12/16

(52) UK CL (Edition K)
G4A AMG1

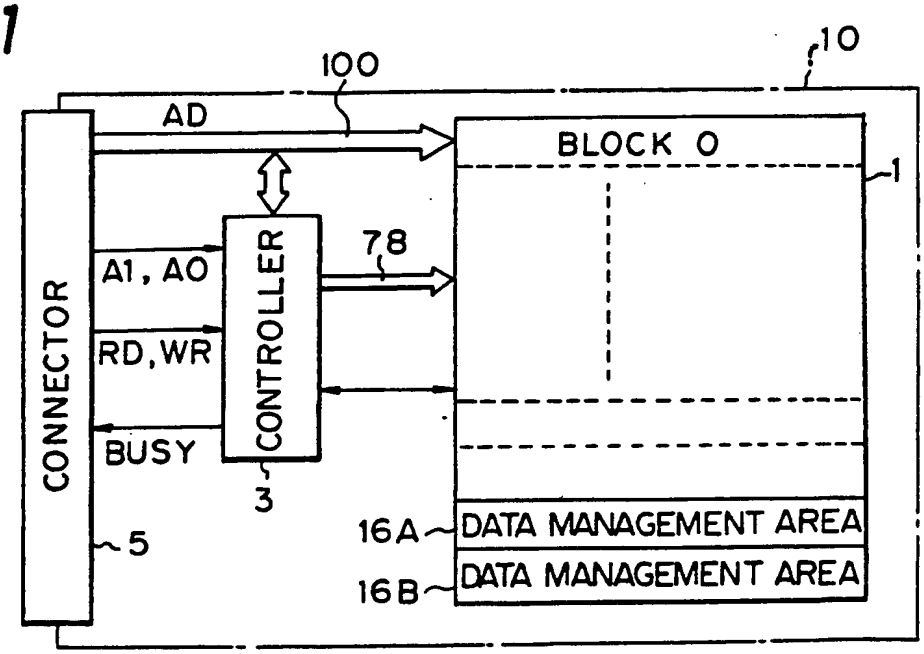
(56) Documents cited
P. Norton, "Programmers guide to the IBM PC & PS/2", 1988, Microsoft Press, See pages 118-121.

(58) Field of search
UK CL (Edition K) G4A AMG1
INT CL[5] G06F

(54) **Data mangement system for memory card**

(57) A memory card (10) for storing data is provided with a storage area divided into storage units (14) each having a predetermined storage capacity. The storage area also has at least two management areas (16A, 16B) for storing information about data stored in each storage unit. The management areas are updated one after the other to prevent data loss in the event of supply interruption during a write operation. Suggested applications include electronic still cameras.

Fig. 1



GB 2 248 707 A

Fig. 1

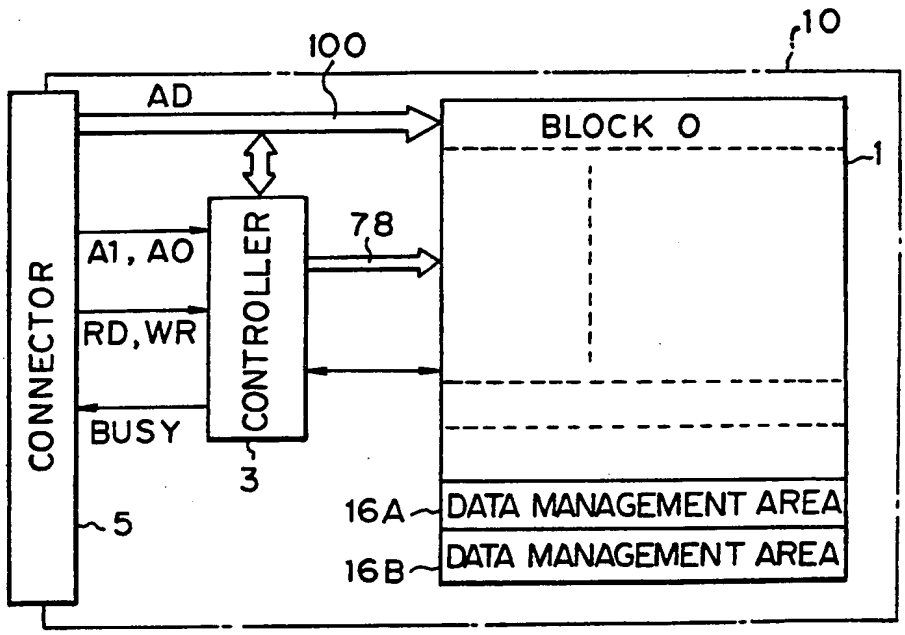

10
100
AD
BLOCK 0
1
78
A1, A0
RD, WR
BUSY
CONTROLLER
3
CONNECTOR
5
16A
DATA MANAGEMENT AREA
16B
DATA MANAGEMENT AREA

Fig. 2

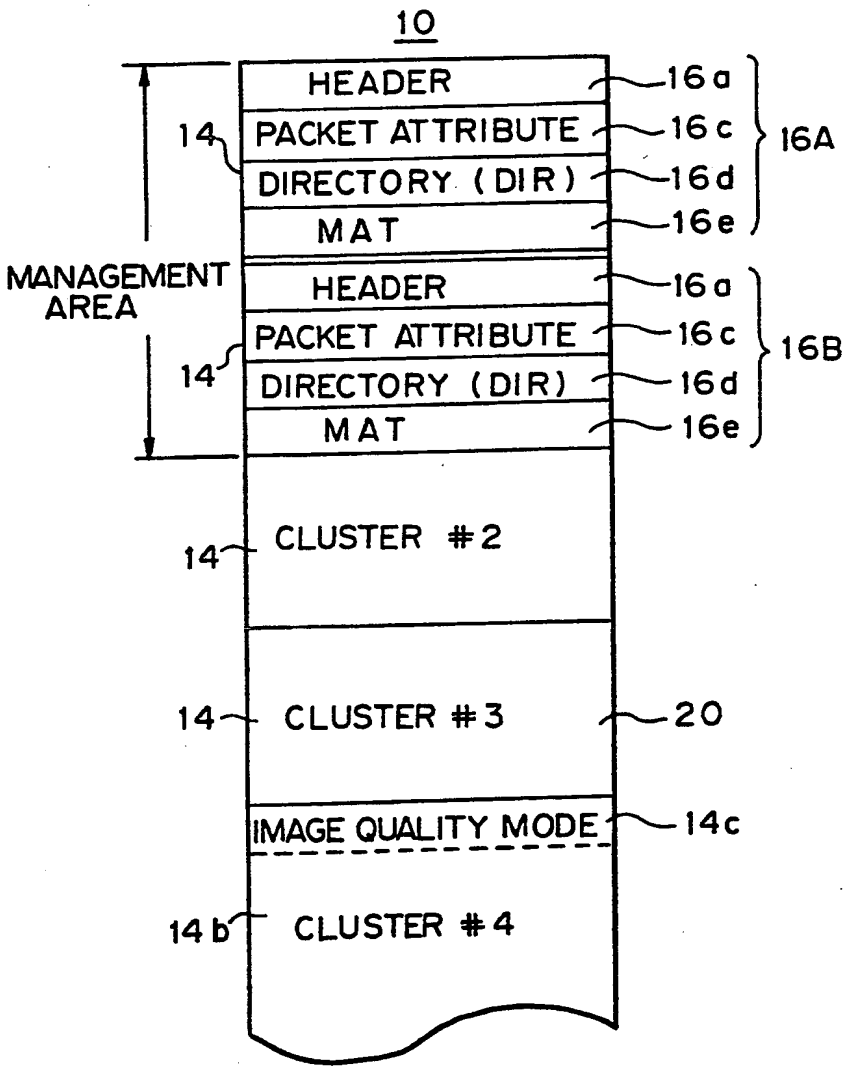

10
HEADER
PACKET ATTRIBUTE
DIRECTORY (DIR)
MAT
16a
16c
16d
16e
16A
14
MANAGEMENT AREA
HEADER
PACKET ATTRIBUTE
DIRECTORY (DIR)
MAT
16a
16c
16d
16e
16B
14
CLUSTER #2
14
CLUSTER #3
20
IMAGE QUALITY MODE
14c
14b
CLUSTER #4

Fig. 3

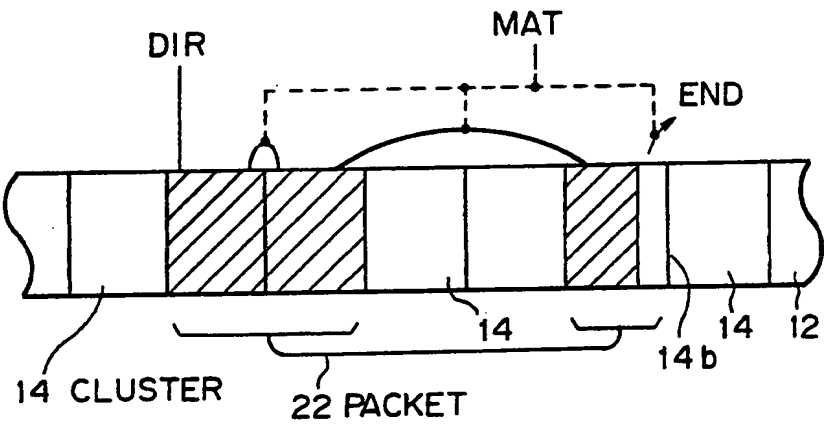


Fig. 4

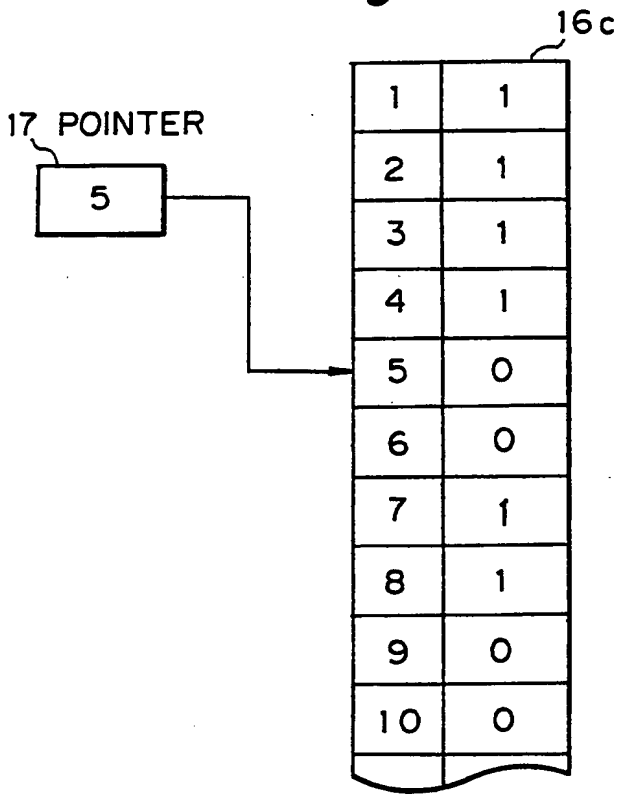

16c
17 POINTER
5
1 1
2 1
3 1
4 1
5 0
6 0
7 1
8 1
9 0
10 0

Fig. 5

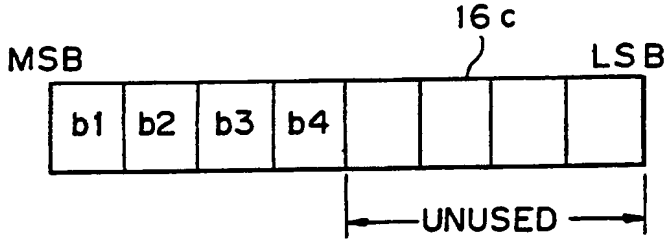
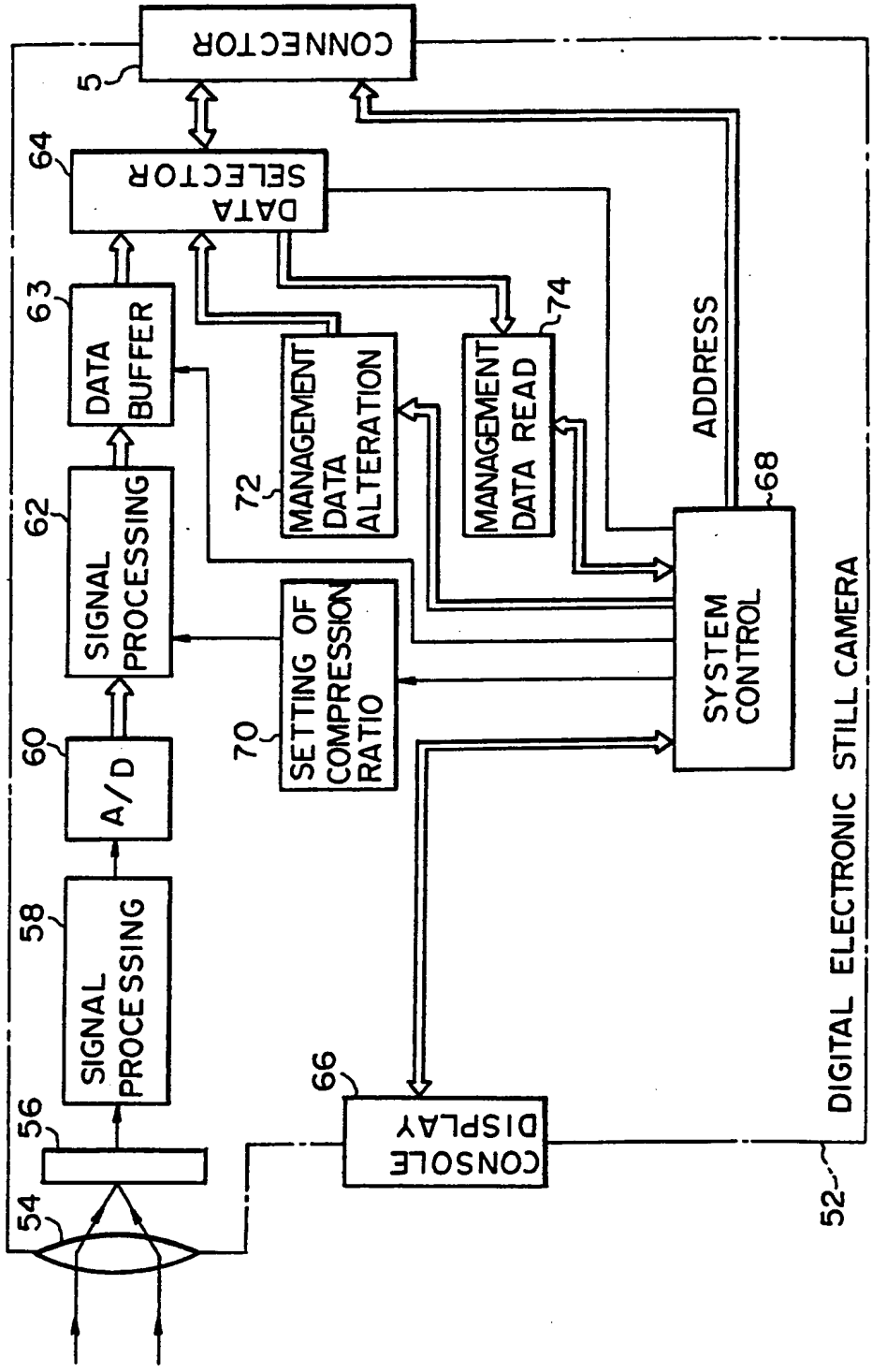

16c
MSB
LSB
b1
b2
b3
b4
UNUSED

Fig. 6


CONNECTOR
5
DATA SELECTOR
64
DATA BUFFER
63
SIGNAL PROCESSING
62
A/D
60
SIGNAL PROCESSING
58
56
54
MANAGEMENT DATA ALTERATION
72
SETTING OF COMPRESSION RATIO
70
MANAGEMENT DATA READ
74
ADDRESS
SYSTEM CONTROL
68
CONSOLE DISPLAY
66
DIGITAL ELECTRONIC STILL CAMERA
52

MEMORY CARD AND DATA MANAGEMENT SYSTEM IN MEMORY CARD

The present invention relates to a memory card for storing data such as image data, and more particularly to a data management system for managing a storage state of the data.

Recently, for instance, in an electronic still camera, there becomes such a tendency that a compact IC memory card using a semiconductor memory is used, instead of a floppy disc, as a medium for recording image data representative of an image captured.

In a system using such a memory card, for example, the field of electronic still cameras, a system for storing in a memory card data representative of an image captured together with management data representative of the order of storage and indication of an storage area occupied is proposed by a co-pending Japanese patent application, No. 120073/1987, filed in the name of the same as of the present application. Also, in a co-pending Japanese patent application, No. 10997/1989, filed in the name of the same as of the present application, there is proposed a memory management system capable of efficiently storing data in variable size. According to such a memory management system, there is so arranged that a memory card is provided with a storage·area divided into a plurality of clusters (storage unit), and the storage of information is managed on each cluster. In this system, the relationship of ones of a plurality of clusters in which an image field of information

is stored is indicated on a memory allocation table (MAT) and a cluster in which the beginning portion of the image field of information is stored is indicated on a directory.

In the memory card of the abovementioned data management system, the management data such as the management table referred to as MAT and the directory is stored in, for instance, the beginning area of the storage areas of the memory card. In the electronic still camera side, on the other hand, the information on the management area is read out to determine a storage location for image data to be newly stored in the memory card, and in addition, new management information is produced and stored in the memory card.

By the way, as the memory card for use in such a system, hitherto, there is used a static RAM (SRAM) capable of performing high speed read out and writing operations. However, the SRAM is a volatile semiconductor memory, and thus it needs a battery for backup. Further, an SRAM for storing a large storage capacity of data such as image data becomes expensive, and then the cost of the memory card becomes high. In view of those problems, recently, it has been scrutinized that an EEPROM (electrically erasable programmable read only memory), that is, a nonvolatile semiconductor memory which is inexpensive and needs no backup battery, is employed in the memory card. The EEPROM is excellent in a memorable period as exceeding 10 years without a battery, and recently, be provided with reading or writing speed equal to that of an SRAM. Further, there has been developed an EEPROM which is about one-fourth of SRAM in cost.

In the EEPROM, however, when programming or rewriting is performed, there is needed such a two-step

operat[redacted] that the previously written data [redacted] erased and then a new writing is performed. As the erasing method, there are known two types one of which is a batch erasing type(flush type), the other a block erasing type. According to an EEPROM in which a block erasing is performed, similar to an SRAM, it is possible to perform rewriting in units of block. However, in a case where the conventional data management system as mentioned above is employed in such an EEPROM, it has been associated with the following drawback. That is, management area of the memory card is provided with only one header. Thus, if there is occurrence of an accident such as disconnection of the electric power supply at the system (camera) when rewriting of the management information is carried out, it is feared that the management information is completely lost, in the worst case, since it is after erasing of the management information. The complete loss of the management information makes it impossible to develop the contents of the card to externals, and thus it is feared that the memory card is unavailable thereafter.

It is therefore an object of the present invention to provide a memory card and a data management system for the memory card capable of providing improvement of security of the memory card, avoiding the complete loss of the management information, even in case of the worst, if an accident occurs when the management information is written into the memory card.

In accordance with the present invention, there is provided a memory card detachably connectable to a host processing apparatus for storing data transmitted from the host processing apparatus. The memory card is provided with a storage area divided into a plurality of storage units each

having a predetermined storage capacity. In the memory card, the storage area is provided with at least two management areas each for storing management information for managing a storage state of data stored in each storage unit.

Further, in accordance with the present invention, there is provided a storage management system in a memory card detachably connectable to a host processing apparatus for storing data transmitted from the host processing apparatus and in addition management information for the data. In the system, the memory card is provided with at least two management areas each for storing management information for managing a storage state of data, and the host processing apparatus provides such a control that when data of the memory card is rewritten, the previous management information stored in the memory card is read out from one of the management areas to produce new management information as to rewriting of the data, and the refreshed management information is written into the at least two management areas of the memory card.

Furthermore, in accordance with the present invention, there is provided a storage management system in a memory card detachably connectable to a host processing apparatus for storing data transmitted from the host processing apparatus and in addition management information for the data. In the system, the memory card is provided with at least two management areas each for storing management information for managing a storage state of data. The memory card is adapted, in rewriting of data, to write management information after rewriting into one of the at least two management areas, and after completion of writing, to transcribe the management information written into the one management area to the other management area, so that the

refres[redacted]management information is store[redacted] the at least two management areas.

The objects and features of the present invention will become more apparent from the consideration of the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a block diagram showing an illustrative embodiment of a memory card according to the present invention;

FIG. 2 is a view showing an example of construction of storage areas of the memory card in the illustrative embodiment of the present invention;

FIG. 3 is a conceptual view showing a storage system applied to the embodiment of the present invention;

FIGS. 4 and 5 are diagrams for explanation which exemplarily show formats of a packet attribute in the example of construction of the storage areas shown in FIG. 2; and

FIG. 6 is a schematic block diagram exemplarily showing an application of the present invention to a digital electronic still camera.

Referring to the accompanying drawings, further details of the embodiment of a memory card and a data management system for the memory card according to the present invention will be given herein after.

As shown in FIG. 1, a memory card 10 according to an illustrative embodiment is provided with a storage unit 1 for storing data, a controller 3 for performing a control of read/write of the data to storage areas of the storage unit, and a connector unit 5 attachable to or detachable from a

host processing apparatus such as an electronic still camera. The storage unit 1 is provided with two data management areas 16A and 16B.

The storage unit 1 is constructed by a block erasing type of EEPROM. As shown in FIG. 2, the EEPROM has a storage area splitted into clusters 14 each having apredetermined storage capacity. In the EEPROM, the erasing is performed in units of cluster. First one (#0) of the clusters 14 is assigned with a first management data area 16A in which management data for image data is stored. Second cluster (#1) is assigned with a second management data area 16B in which the same management data for image data isstored. The remainder of the storage area 14 according to the illustrative embodiment is used as image data areas 20 in which image data are stored. The storage capacity of the cluster 14 may be optionally determined. For example, the capacity may be of a size enough to store a fraction of a positive integer for image data, which is necessary to represent a picture image in the form of a standard video signal format, and called "a packet" (FIG. 3). The packet 22 may be interpreted to be a data unit including an audio data related to the image data.

In each of the management data areas 16A and 16B, as shown in FIG. 2, there are stored a header 16a, a packet attribute 16c, a directory (DIR) 16d and a memory allocation table (MAT) 16e.

In the illustrative embodiment, basically, a single packet of image data 22 is stored in an optional cluster 14. Stored in the MAT area 16e are data, that is, MAT data, indicating the relationship of the clusters 14 which have stored the single packet of image data 22. The MAT data, for

example as shown in FIG. 3, in conjunction with the cluster 14 storing a part of the single packet of image data 22, includes identification information, such as numerical figures, pointing out another cluster in which stored is another part of the remainder of the image data 22, which is directly associated with the former part of the image data 22. When there is no remainder of the image data 22, the MAT data indicates with a predetermined code "ALL 1" (a binary value), for example, that cluster 14 is the last one in the packet 22. More in detail, in MAT area 16e, there are stored the numerical figures of the subsequent cluster 14, using two bytes on each cluster. According to this embodiment, when the cluster 14 stores no image data, for instance, in an unused state or an erased state, the value of MAT 16e is given with "ALL 0", and when the MAT 16e is the end of packet 22, the value of MAT 16e is given with a predetermined code, for example, "ALL 1", that is, hexadecimal "FFFF". Further, in a case where there is other cluster 14 following the packet 22, the value of MAT 16e is given with a value indicating the numerical figure of such a subsequent cluster 14.

Stored in the directory area 16d is information indicating a start cluster and a data assortment. The start cluster information is identification information, such as a start cluster No., indicating the cluster 14 which has stored the first portion of the image data on a unit image basis, that is, on each packet 22. Thus, in which cluster 14 an image field of data has been stored is specified. The information indicating a data assortment indicates an assortment of information stored in the storage unit 1, for example, image data, audio data, character data, program and so on.

In an application of the storage unit 1 having the storage capacity of 64M bits, 1024 pieces of the clusters 14 each having the capacity of 64k bits can be established. The respective clusters 14 are provided with numbers #0 to #1023 in the sequence of physical arrangement. Assigned to the clusters #0 and #1 are the management areas 16A and 16B, respectively, and management data are stored therein. The management data, in the illustrative embodiment as shown in FIG. 2, includes header 16a, packet attribute 16c, directory 16d and MAT 16e that are stored in the respective sub-areas. Stored in the remaining clusters #1 to #1023 are image data for example that also include header information particular to individual images.

A single packet 22 is stored in one or more clusters 14. Consequently, it can also be said that a packet is a logical area in which stored is image data representative of an image field. Given to the packets 22 are numerical figures in the practical sequence, for example, in the sequence of storing image data, etc. When some packet 22 is erased, the number given to that packet becomes a space, which will later on be allotted to new image data to be stored in that packet thereafter. A packet of the image data 22 is stored in a single cluster 14 or a plurality of clusters 14. In the last cluster 14, there sometimes happens to exist a space area 14a, FIG. 3. The number of packets 22 that can be stored in the storage unit 1 is equal to the number obtained by subtracting 2 from the total number of the clusters 14 in the storage unit 1.

In the directory 16d, the number of the first cluster 14 on each packet 22 is stored. In the illustrative embodiment, as there are 1024 clusters, for instance, 10 bits are used for the start cluster numbers and other bits are

left used. Unused directory is indicated "ALL 0".

Further, according to the present illustrative embodiment, the management data areas 16A and 16B are provided with packet attribute areas 16c, respectively. The packet attribute 16c includes information indicating, on each packet 22, as to whether it is used or not, and in addition, may include indication concerning, for example, yes or no of writing over, yes or no of copy and yes or no of reading out. More in detail, the packet attribute area 16c may be provided, as shown in FIG. 4, by a bit map scheme in which one bit per a packet is allocated in an indication, and each of the bits indicates whether or not the associated packet 22 has been occupied. In the illustrative embodiment, binary "1" indicates the state of the packet 22 being occupied, while binary "0" indicates the state of the packet 22 being free. A bit map pointer 17 indicates a specific packet position on the bit map.

FIG. 5 shows an example of the packet attribute 16c in which a single packet 22 comprises one byte of which 4bits are used for indication of the packet attribute. The first bit b1 of the most significant bit MSB indicates yes or no of writing over, writing protection being represented by "1", and allowance of writing over being represented by "0". In this case, it may be interpreted that the writing over includes erasing. The second bit b2 indicates vacancy or occupation of packet 22, "1" representing occupation, "0" representing vacancy. The third bit b3 indicates yes or no of copying of information stored in the storage unit 1, a copy inhibition being represented by "1", a copy allowance being represented by "0". Similarly, the forth bit b4 indicates yes or no of reading out of information stored in the storage unit 1, reading out inhibition being represented

by "1", reading out allowance being represented by "0". For instance, regarding a packet which became unusable on storage area 20, "11X1XXXX" is indicated as the packet attribute 16c, where "X" is a bit representing "don't care".

Stored in the header 16a are the number of occupied clusters, the number of remaining clusters, a maximum active packet number, first free packet number and parity 16b. The number of occupied clusters is data representative of total numbers of the clusters 14 in which image data are effectively written on the storage area 20. The number of remaining clusters is data representative of the number of clusters 14 which are available for writing of the image data on the storage area 20, that is, the number of free clusters 14. There is sometimes a memory card 10 of which ROM area (not shown) stores data representative of a storage capacity of the storage area. In case of such a card, the number of occupied clusters and/or the number of remaining clusters are available for check, upon comparison of their numbers with the storage capacity, of rationality thereof.

The maximum active packet number of the header 16a is data representative of a packet having the largest packet number among the packets 22 stored in the storage area 20. In this case, while there sometimes happens to exist erased one among a series of active packets, the largest packet number becomes the maximum active packet number. When the memory card 10 is mounted on a regenerative apparatus to read out the image data 20 on the card, the regenerative apparatus loads thereinto, as will be explained later, the packet attribute 16c and directory 16d. In such a case, referring to the maximum active packet number makes it possible to grasp the amount of use of those, and thus possible to restrict the loading area. The first free packet number

indicates youngest number among the free packets on the storage area 20. The first free packet number can be written, for example, when the image data are reproduced by the regenerative apparatus. This makes it possible, when the memory card 10 is mounted on the electronic still camera 52 (FIG. 6) to perform an image recording, to reduce a processing load of the camera 52.

A header 16a may include a maximum active cluster number and a first free cluster number in addition to or instead of the maximum active packet number and the first free packet number. The maximum active cluster number is data representative of a cluster having the largest cluster number among the clusters 14 stored in the storage area 20. In this case also, while there sometimes happens to exist vacant one among a series of active clusters, the largest cluster number becomes the maximum active cluster number. The first free cluster number indicates youngest number among the free clusters on the storage area 20. The maximum active cluster number and the first free cluster number may provide the similar effects as discussed on the maximum active packet number and the first free packet number.

The header 16a includes a parity area and be provided with one byte as a storage area designated with one address. The parity is obtained by means of calculation of the parity located in an address direction of bits associated with the respective digits all over the byte of the header 16a, that is, in a vertical direction, and is stored in a memory location of the final address of the header data area 16a. This calculation is realized by means of performing addition on each digit on a binary basis and deleting carry. Thus, it is possible to check normality of data contents of the header data area 16a. While the present illustrative

embodiment utilizes the parity check, it is possible to employ a checking code system capable of correcting errors, for example, CRC code etc.

Header 16a may include, in addition to the parity area, a user area for storing user data, for example, a card number, a name and so on, with which a user can provide the memory card 10. Further, the header 16a may include format version data for identification indication which indicates assortment of the card 10, for example, such that the card is for an image. The format version data is utilized, in a case where memory cards other than a predetermined kind of cards 10 are connected to a recording apparatus and a regenerative apparatus, for example, in such a case that a memory card for use in data processing is mounted on an electronic still camera, for protection of those apparatuses and cards.

By the way, as exemplarily shown in cluster #4 in FIG. 2, data 14c indicating an image quality mode is stored in a first cluster of some packet 22. The image quality mode 14c indicates a mode of an encoding compression of image and/or audio data for forming the packet 22. For example, the image data varies a packet of total data quantity in accordance with a standard mode, and the encoding compression mode such as a high density compression mode having a compression ratio one bit/pel for example, and thus varies the required number of clusters capable of storing a packet of compressed image data. According to the present illustrative embodiment, when the image data is stored in the memory card 10 in a recording apparatus such as an electronic camera, the image quality mode 14c is written into a first cluster 14b of the packet 22. This makes it possible for a

regen[redacted]ive apparatus, when regenerated [redacted] identify the number of clusters 14 to be accessed.

Now again referring to FIG. 1, the controller 3 is operative, in response to control signals transmitted through connector 5, to transmit enabling signal ES for read and write of data to the storage unit 1, and also to transmit address signal AD transmitted through bus 100 to the storage unit 1. As the control signals transmitted from or to a camera end, there are state signals A0, A1 representative of distinction between an address signal or a data signal transmitted through the bus 100, read signal RD for read out of data, write signal WR for writing of data, busy signal BUSY indicating "now in processing" and so on. The controller 3 according to the illustrative embodiment has such a function that in the event that the card 10 is mounted onto the camera and management data is read out, control for reading out the management data from either the management area 16A or 16B of the storage unit 1 is performed, and thereafter a signal for erasing the management data on the area subjected to such a reading out is transmitted to the storage unit 1. Further, according to the controller 3, there is provided such a control that in the event that management data renewed at the camera end is transmitted, the renewed management data is written into the erased management area 16A or 16B, and upon completion of the writing, the other management area is erased to transcribe thereto the management data written in the one management area. The connector unit 5 is constructed by, for example, a connector having 20 pins along "IC memory card guideline" by Japan Electronic Industry Development Association (JEIDA).

FIG. 6 shows an illustrative embodiment wherein such a storage management system as mentioned above is applied to a digital electronic still camera. In the

illustrative embodiment, a memory card 10 is detachably connected to a digital electronic still camera 52 through a connector 5. The camera 52 is a still picture photographing device which photographs a field by an image picking-up device 56 through an optical lens system 54 to store the image data representative of the field in the memory card 10. The picking-up device 56 produces an output, which is in turn subjected to signal processing, such as color regulation, in a signal processing circuit 58 and converted into the corresponding digital data through an analog/digital (A/D) conversion circuit 60. Those digital data are processed with color separation and compression encoding in a signal processing circuit 62 and then transmitted to the connector 5 through a data selector 64.

The camera 52 has a console and display 66, which receives various manual instructions such a exposure, data compression mode and write protect designations, and also indicates the state of the system to the user, such as alarm indicative of the state in which there exists no idle cluster available to storing a record of image data. Console and display 66 transmits data representing the designations fed therein to a system control 68. The information on the state of the camera 52 is fed to the console and display 66 from the system control 68.

The system control 68 is a control unit which not only controls the entire operations of the camera 52 but also writes data in the memory card 10. Connected to the system control 68 is a compression ratio setting circuit 70 which is a circuit for setting a compression ratio of codes for image data to a signal processing circuit 62 in accordance with a data compress mode indicated by the console and display 66 under the control of the system control 68.

As the compression coding method, an orthogonal transform such as a two-dimensional cosine transform, or the sub-sampling, and the quantization are advantageously applicable.

The data selector 64 is a selector circuit which sends out image data from the signal processing circuit 62 and control data involved in the system control 68 selectively through the connector 5 to the memory card 10. Connected to the data selector 64 are a management data alteration circuit 72 and a management data read-out circuit 74. The management data alteration circuit 72 is a circuit which generates data to be written in the management areas 16A and 16B of the memory card 10. The management data read-out circuit 74 reads out management data stored in management data areas 16A and 16B of the memory card 10 and then feeds those to the system control 68.

In an operational condition, when the memory card 10 is connected through the connector 5 to the camera 52, the system control 68 causes the management data read-out circuit 74 to read out sequentially the header 16a - MAT 16e stored in management data area 16A (or management data area 16B) of the storage unit 1 of the memory card 10. More in detail, addresses of areas of the header 16a - MAT 16e of the management area 16A are designated by addressing circuit 76 through address bus 78, so that the header 16a - MAT 16e read out from the management area 16A of the storage unit 1 are read out by the management data read-out circuit 74 through the connector 5 and the data selector 64. When those management data are read out from the management data area 16A and be transmitted to the system control 68, the system control 68 sends out the received signals through the connector 5 to the memory card 10. In the memory card 10,

upon receipt of the receiving signals, the controller 3 transmits to the storage unit 1 a signal for erasing the content of the management area 16A, so that the content of the management area 16A are erased to prepare writing of renewed management data.

The system control 68, upon receipt of the management data, first checks a format version included in the thus read out header 16a. According to the present illustrative embodiment, if such a format version has no indication for image, the console display 66 displays such an indication that the associated memory card is to be excluded. Further, if it includes a card number of a user, it also be displayed. Next, there is performed a parity check on the header 16a. A result of the parity check is compared with the parity included in the header 16a. This parity check is, as aforementioned, achieved by means of performing addition on each digit on a binary basis in an address direction of bits associated with the respective digits all over the byte of the header 16a and deleting carry.

If a result of the parity check is preferable, the system control 68 carries out check as to the number of clusters. This check is to calculate a total number of clusters in the storage area from a card capacity read through the memory card 10 and check as to whether the total number of clusters is equal to a sum of the number of occupied clusters and the number of remaining clusters. The number of occupied clusters and the number of remaining clusters are the management data included in the header 16a. If it is successful in this check, the system control 68 causes the console display 66 to display "ready to capture".

The system control 68 controls, in response to an

operation of a capturing button of the console display 66, the image picking-up device 56 so as to photograph a field. The picking-up device 56 produces an output, which is in turn subjected to signal processing, such as color regulation, in a signal processing circuit 58 and converted into the corresponding digital data through an analog /digital (A/D) conversion circuit 60. Those digital data are processed with color separation in a signal processing circuit 62 and compression encoding in a compression ratio set by compression ratio setting circuit 70 and then transmitted to the memory card 10 through a data buffer 63, a data selector 64 and the connector 5.

At that time, the system control 68 reads MAT data 16e from the management data area, and searches a cluster given with the vacant indication "all 0". The number of clusters necessary for storage of one packet 22 is calculated by the system control 68 based on the compression ratio designated by the compression ratio setting circuit 70. Thus, the system control 68 generates an address for designating a first storage location of the required clusters 14 in the storage area 20, and transmits the same to the card 10. In the card 10, the control circuit 3 generates on the address bus 78 a storage location address in each cluster 14, so that the image data on the data bus 100 is written into the image data storage area 20. At that time, data representative of the image quality mode 14c according to the compression ratio is written into the first cluster 14b.

Thus, when a packet 22 of image data and, if required, the associated audio data have been stored in the storage area 20, the system control 68 controls management data alteration circuit 72 to renew MAT 16e. That is, in

order to provide a continuity of the clusters 14 used in recording of a packet 22 of image data, described in MAT 16e are the associated successive cluster numbers corresponding to the clusters 14, respectively, and "all 1" is described in the last cluster. The management data alteration circuit 72 transfers the thus renewed MAT data 16e to card 10, and such a data is written into the management data area 16A.

Similarly, the directory 16d is also renewed. Alteration of the directory 16d is performed on data assortment and a start cluster. The start cluster is a first cluster number of a series of clusters used in recording of a packet 22 of data. This is formed in the management data alteration circuit 72 and be stored in the management data area 16A of the card 10.

The system control 68 next renews the packet attribute 16c, that is, sets the attribute indication on the packet 22 stored in the card 10. According to the bit map scheme shown in FIG. 4, there is provided an occupied state indication "1" for the packet attribute bit of the stored packet 22. According to the scheme shown in FIG. 5, a bit b2 indicating an vacant state or an occupied state of the packet 22 is set to an occupied state indication "1". Further, there are set a bit b1 indicating yes or no of writing over, a bit b3 indicating yes or no of copy, and a bit b4 indicating yes or no of reading out, in accordance with a state set on the console display 66. Those data are also transferred to the management data area 16A of the card 10.

Finally, the system control 68 performs rewriting of header 16a. An addition of the number of occupied clusters is carried out in accordance with the number of

clust[redacted] required for storage of a packet [redacted] of data, while a subtr[redacted]tion of the number of remaining clusters is carried out, so that the first free packet number is renewed. If there is change in the maximum active packet number, this is to be renewed. It is similar also on the first free cluster number and the maximum active cluster number. There is formed the parity located in an address direction of bits associated with the respective digits on the whole data of the thus renewed header 16a as a result, that is, in a vertical direction, and as a result the parity 16b is renewed. The renewed header 16a is written into the management data area 16A.

As explained above, in storage of the image data into the memory card 10, written into the card 10 is the image data 20, MAT 16e, directory 16d, packet attribute 16c and header 16a in the order named. In this case, if there happens such a matter that the card 10 is pulled out from the connector 5 in mid course of these serious operations, or if there is occurrence of inadvertent accident such as disconnection of the electric power supply at the system (camera) when rewriting of the management information is carried out, the management information would be lost, since it is after erasing of the management information. According to the memory card 10 in the present embodiment, however, there has been stored the same management information in the management data area 16B, and thus it is possible to produce refreshed management data by means of repetition of the interrupted operation, upon again reading the same management information. In such a situation, when the management data is read out from the management data area 16B later, only a necessary portion of the management data on the management data area 16B is read out without erasing. As a result, it is possible to effectively perform recording and reproduction

operations of the memory card 10 later. After the renewal of the management data is performed in its entirety, so that the management data is completely stored in the management data area 16A, the controller 3 provides such a control that the content of the management data area 16B is erased, and the refreshed management data stored in the management data area 16A is transcribed to the management data area 16B, thereby preparing for the next time of data alteration.

While the above illustrative embodiment has been explained such a case that the management data consists of four pieces of management data such as header 16a-MAT 16e, the present invention is not restricted by the number of such pieces of management data and also the data management scheme. That is, the present invention includes any systems provided with at least two management areas each for storing information necessary for management of main data. Further, according the above illustrative embodiment, while EEPROM has been explained by way of the example as the storage unit of the memory card, other semiconductor memories such as SRAM may be used. Furthermore, according the above illustrative embodiment, while it is so arranged that in the inside of the memory card 10 the management data renewed in one of the management areas is written into the other management area, it may be modified such that the management data renewed from the system or camera end is written into the other management area again from the camera end.

As explained above, according to the present invention, the memory card is provided with at least two management areas for storing management information for management of data storage state. Thus, if there is occurrence of accident such as disconnection of the electric power supply at the system or camera end when rewriting of

the management information is carried on one of the management areas, it is possible, upon read-out of the management data stored in the other management area, to continuously perform the rewriting of the management information. Consequently, according to the present invention, it is possible to prevent the management data of the card from disappearing, and also to avoid such serious problems that inadvertent accidents at a host end such as camera end disenable development of the contents of the card, or cause the card to be unavailable.

While the present invention has been described with reference to the particular illustrative embodiment, it is not to be restricted by the embodiment but only by the appended claims. It is to be appreciated that those skilled in the art can change or modify the embodiment without departing from the scope and spirit of the present invention.

CLAIMS

1. A memory card detachably connectable to a host processing apparatus for storing data transmitted from said host processing apparatus wherein

said memory card is provided with a storage area divided into a plurality of storage units each having a predetermined storage capacity, and

said storage area comprises at least two management areas each for storing management information for managing a storage state of data stored in each of the storage units.

2. A memory card according to claim 1, wherein said storage area includes an additional storage unit for storing data, said at least two management areas being formed in said additional storage unit.

3. A memory card according to claim 2, wherein said additional storage unit is constructed with a semiconductor memory.

4. A memory card according to claim 3, wherein said semiconductor memory is an EEPROM.

5. A memory card according to claim 3, wherein said semiconductor memory is an SRAM.

6. A memory card according to claim 1, wherein said memory card further comprises a controller for performing a control of read/write of the data to the storage area,

and a connector unit detachably connectable to the host processing apparatus to said controller and storage area.

7. A memory card according to claim 6, wherein said host processing apparatus is an electronic still camera.

8. A memory card according to claim 6, wherein said plurality of storage units are constructed with a semiconductor memory.

9. A memory card according to claim 8, wherein said semiconductor memory is an EEPROM.

10. A memory card according to claim 8, wherein said semiconductor memory is an SRAM.

11. A storage management system in a memory card detachably connectable to a host processing apparatus for storing data transmitted from said host processing apparatus and in addition management information for the data, wherein

said memory card is provided with at least two management areas each for storing management information for managing a storage state of data, and

said host processing apparatus provides such a control that when data of said memory card is rewritten, the previous management information stored in said memory card is read out from one of the management areas to produce new management information as to rewriting of the data, and the new management information is written into said at least two management areas of said memory card.

12. A [redacted]em according to claim 11, wh[redacted]n said host processing apparatus is an electronic still cameras.

13. A storage management system in a memory card detachably connectable to a host processing apparatus for storing data transmitted from said host processing apparatus and in addition management information for the data, wherein

said memory card is provided with at least two management areas each for storing management information for managing a storage state of data, and

said memory card is adapted in rewriting of data, to write management information after rewriting into one of said at least management areas, and after completion of writing, to transcribe the management information written into said one management area to the other management area, so that the refreshed management information is stored in said at least two management areas.

14. A storage management system substantially as described herein with reference to any one of the figures.

15. A memory card substantially as described herein with reference to any one of the figures.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
91[redacted]0.3

Relevant Technical fields

(i) UK Cl (Edition K) G4A (AMG1)

(ii) Int Cl (Edition 5) G06F

Search Examiner

S J PROBERT

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

18 DECEMBER 1991

Documents considered relevant following a search in respect of claims 1-15

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	P.NORTON, "PROGRAMMERS GUIDE TO THE IBM PC & PS/2", published 1988, MICROSOFT PRESS, SEE PAGES 118-121	1-5, 11, 13

Category	Identity of document and relevant passages	to cla

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).